Harnessing Ted's poetic electrons: Decoding water quality with aquatic invertebrates

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The Mayfly is a frail accompaniment

The way Aurora Borealis is frail

What is it doing on earth? And under the river?

Ted Hughes, from ‘The Mayfly’

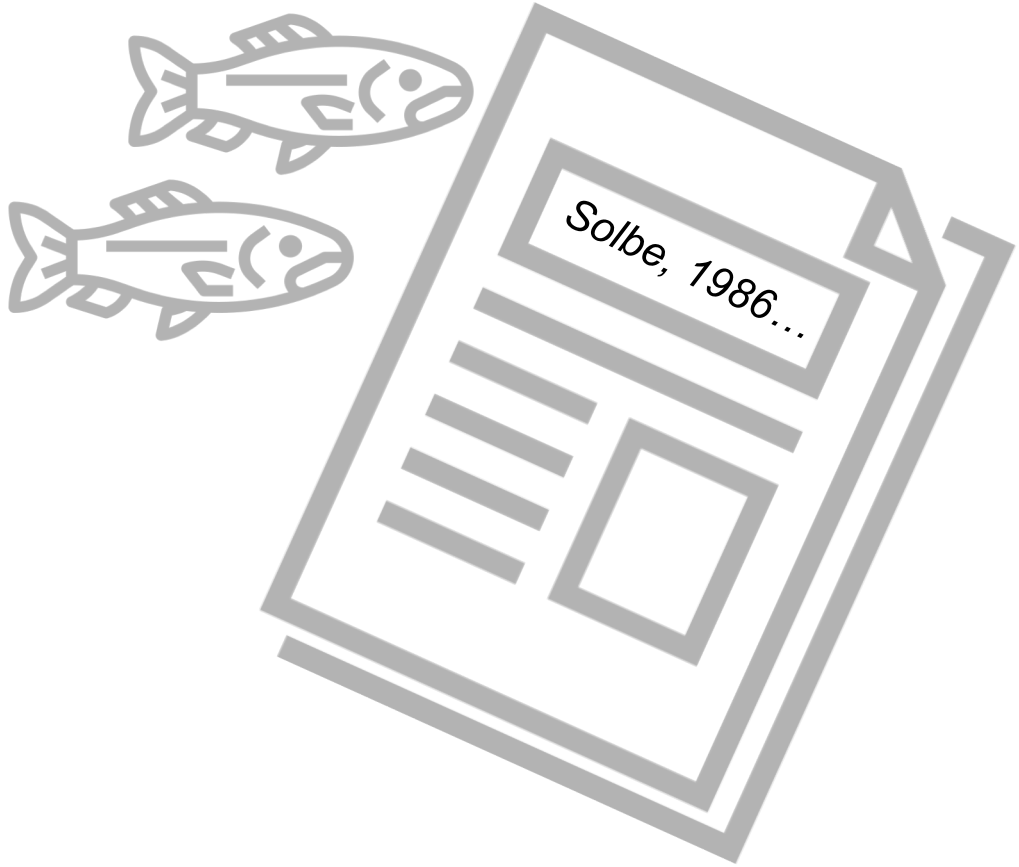
"Ted Hughes Mayfly poems are
a vision of ecological interconnection
to all those concerned with the health of
our waters."
Mark Wormald

This interconnection is not just visionary
it is **rooted in hard scientific fact**.

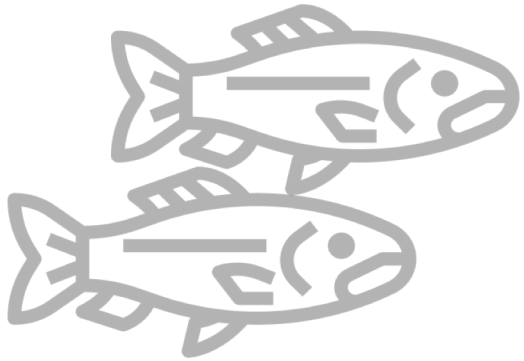
We are harnessing the power of Ted's poetic electrons to diagnose threats to water quality.

The importance of water quality has in supporting '**nature's hatchery**' of wild salmonids has been widely acknowledged for a long time. See:
Water Quality for Salmon and Trout, John Solbé, 1986

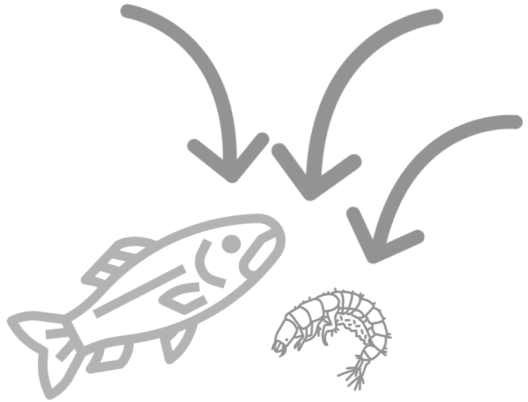
Despite all this evidence, water quality is still largely ignored as a key factor in the conservation of salmon.



Gross pollution of dark satanic mills has given way to more **subtle but ultimately lethal** impacts.

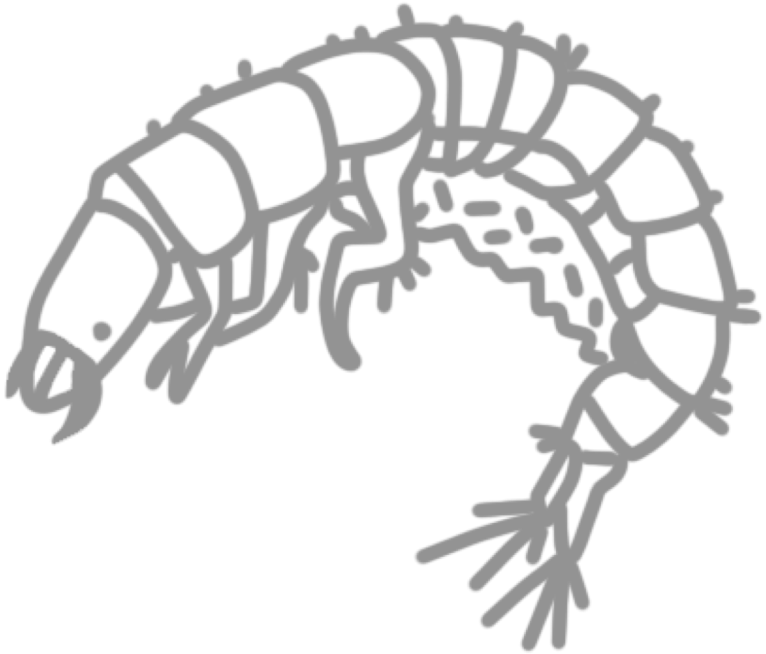


Exposure of young salmon and trout to these impacts, leads to **stress** and **poorer quality** fish.



Invertebrates live in the same habitat as these fish, so experience **the same water quality pressures**.

Pinpointing water quality pressures



Each invertebrate species has a **unique tolerance** to types of water pollution.

Presence and absence of certain species in a sample, can indicate what pollution a river may be experiencing.

As nymphs, invertebrates are constantly exposed to the water, sometimes for years, giving a **broader picture** of river health than a water sample.

Unlocking the code…

Step One: A three-minute kick-sweep sample with one-minute hand search

Unlocking the code…

Serratella ignita
Blue Winged Olive

Step Two: Analysing the catch to species level

Unlocking the code…

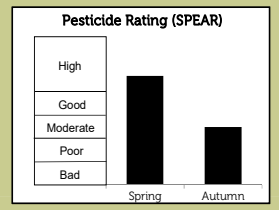
Salmon & Trout Conservation

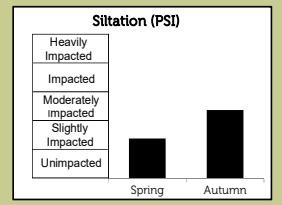
Species	Spring	Autumn
Beetles & Bugs		
Elmis aenea	135	5
Limnius volckmari	22	
Orectochilus villosus	7	
Corixidae		3
Hydroporus		2
Haliplidae		1
Elophila nymphaeata	1	
Caddisflies		
Hydroptila	249	
Hydropsyche pellucidula	156	12
Ithytrichia lamellaris	61	
Hydropsyche siltalai	52	
Sericostoma personatum	26	1
Oxyethira	20	
Polycentropus flavomaculatus	19	
Mystacides azurea	18	
Odontocerum albicorne	15	2
Glyphotaelius pellucidus	15	
Lepidostoma hirtum	11	
Polycentropus irroratus	11	
Rhyacophila dorsalis	8	3
Anabolia nervosa	6	
Athripsodes	4	
Lype reducta	3	
Plectrocnemia conspersa	3	
Silo nigricornis		5
Limnephilus decipiens		3
Potamophylax latipennis		1
Crustaceans		
Gammarus pulex	649	723
Asellus aquaticus	108	16
Leeches & Flatworms		
Erpobdella octoculata	81	17
Glossiphonia complanata	9	2
Piscicola geometra	5	
Helobdella stagnalis		6

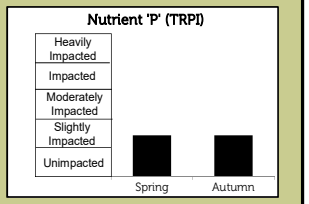
Species	Spring	Autumn
Mayflies		
Caenis rivulorum	277	
Baetis rhodani	77	
Serratella ignita	75	3
Rhithrogena	21	
Heptagenia sulphurea	9	
Centroptilum luteolum	4	
Ephemera danica	4	
Baetis		30
Molluscs		
Potamopyrgus antipodarum	30	3
Anisus vortex		8
Radix balthica		4
Physa		2
Stoneflies		
Isoperla grammatica	17	
Leuctra geniculata	16	
Leuctra fusca	5	
Leuctra		2
True flies		
Orthocladiinae	159	19
Prodiamesa olivacea	66	
Simulium	38	
Tanypodinae	34	
Antocha	16	
Hemerodromia	6	
Simulium ornatum group		16
Tanytarsini		5

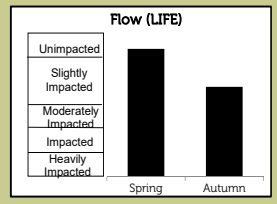
River Itchen - Site 3 Itchen Abbas
2017

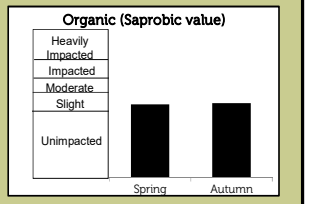
	Spring	Autumn
BMWP	185	127
ASPT	6.61	5.52
WHPT	197	124
ASPT	6.80	5.37
Number of Taxa	28	23
Riverfly - species	27	10
Riverfly - numbers	1182	62
CCI	16.12	8.53
LIFE	8.19	7.39
PSI	72.00	52.27
SPEAR	51.56	27.39
TRPI 4	71.43	71.43
Saprobic	2.02	2.05







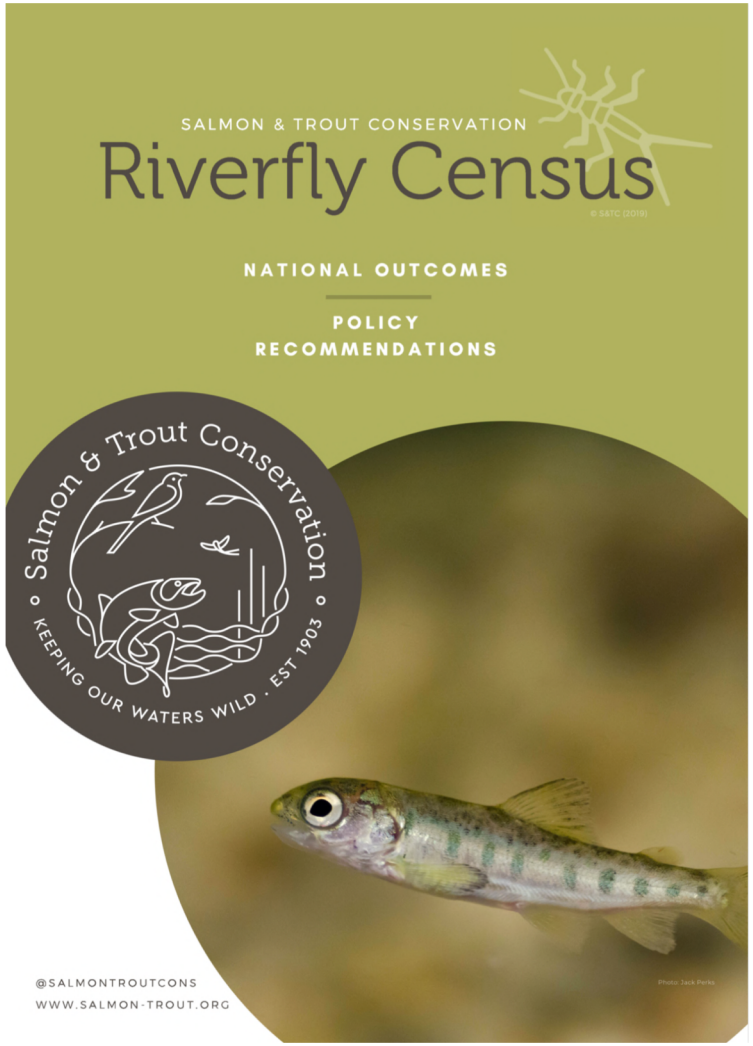




Step Three: Putting the species list into the calculator and working out the pressure scores

The Riverfly Census

We conducted a three-year national project to really test the power of **species-level** invert monitoring.



We kick-sampled rivers for invertebrates all over England and Wales and analysed them to species-level to achieve two main goals:

Definition of a high-resolution water quality benchmark, documenting the 'state of things' now.

Pinpointing what the main sublethal pressures threatening water quality really are.

Outcomes

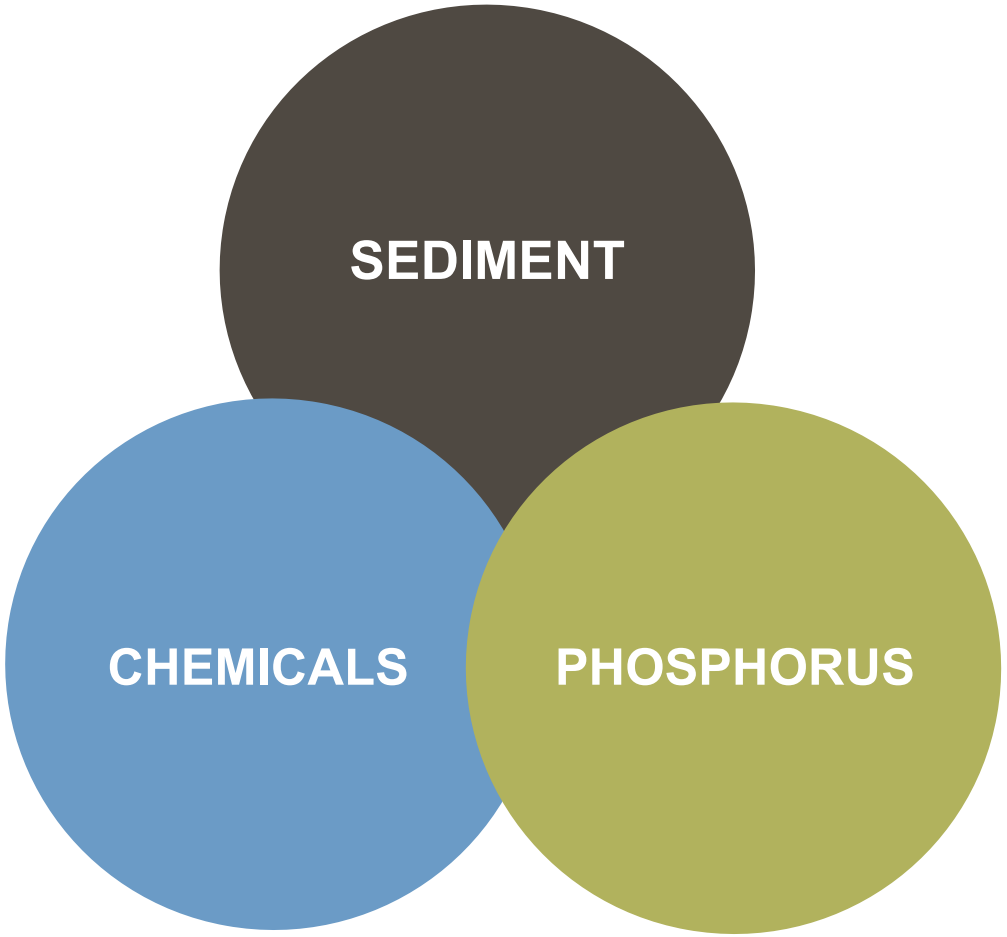
The Riverfly Census

We analysed **34,000** organisms from **more than 480** macro-invertebrate taxa

8 national water policy recommendations

Local reports for Census rivers, with action recommendations

Huge national database that is constantly growing



Outcomes

The Riverfly Census

Three main pressures were consistently indicated in our survey rivers.

These things are **hard to see** but have a big impact on river function.

Species-level monitoring has allowed us to get much needed understanding of the whereabouts and magnitude of these pressures.

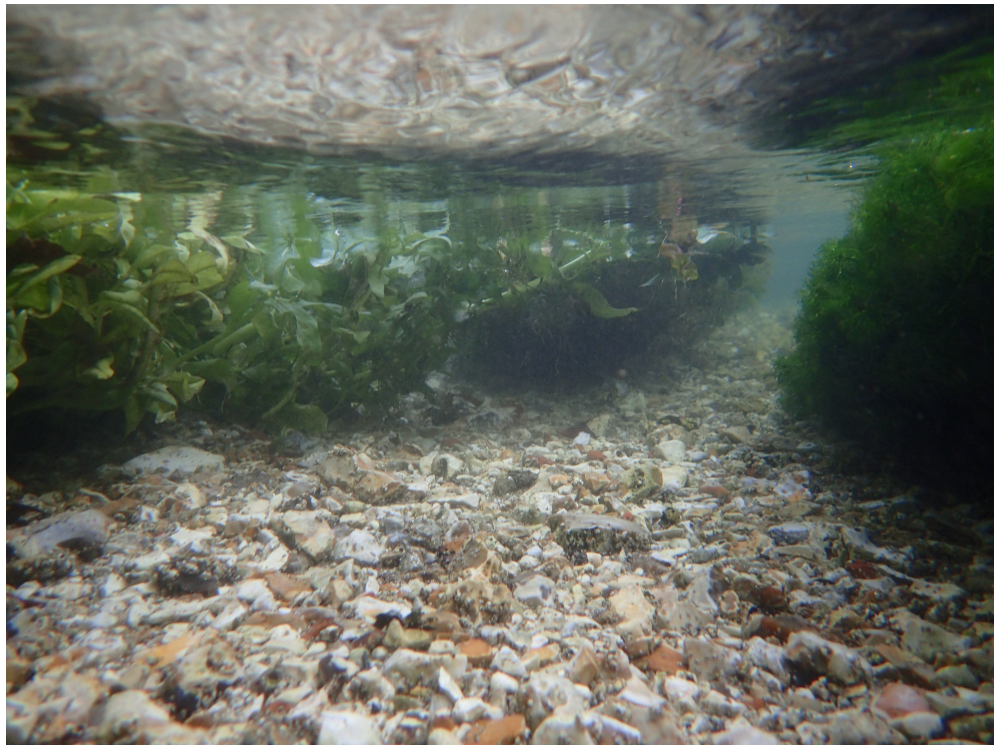
https://www.salmon-trout.org/wp-content/uploads/2019/05/15MB-STC-Riverfly-Census-National-Outcomes_compressed-1.pdf

Concerning SPEAR signatures coupled with low Gammarus numbers and mayfly species richness lead us to investigate below the Bakkavor salad washing factory.

The Upper Itchen

A case study of national importance

What we expected to see in the upper reaches of a chalkstream….



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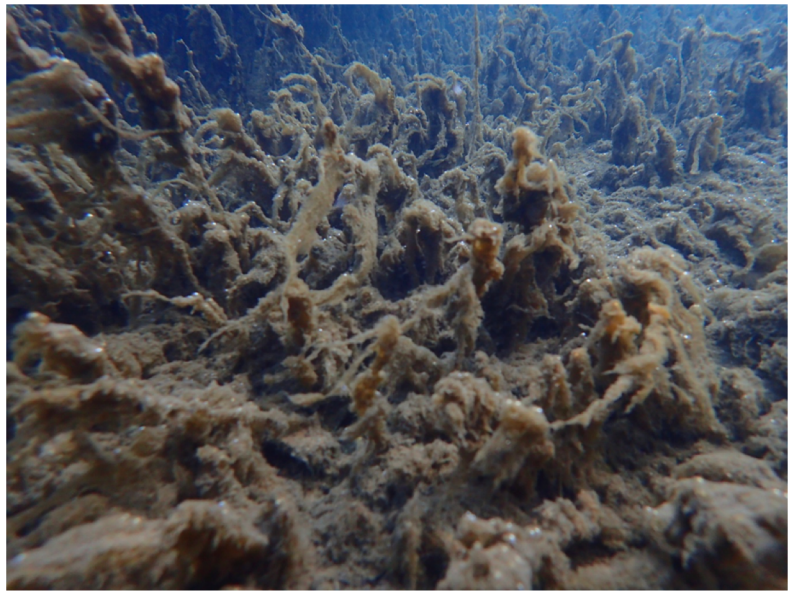
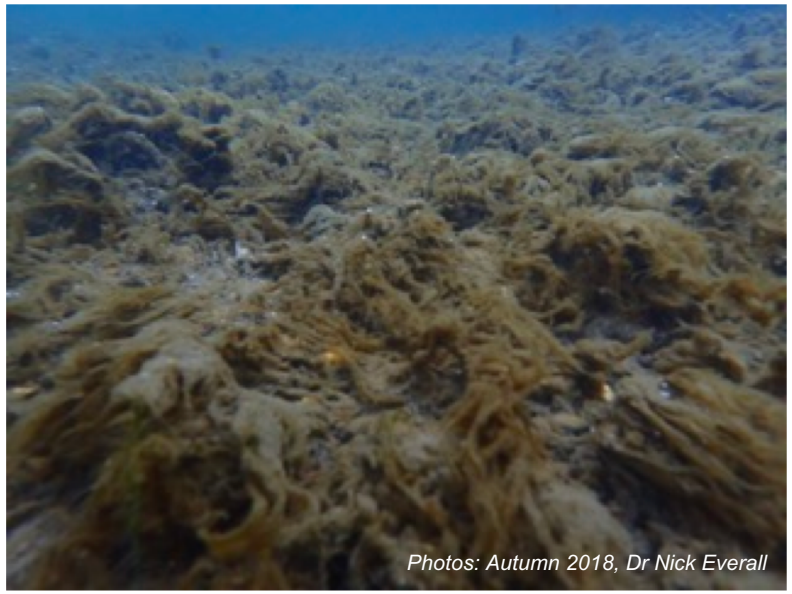
What we actually found….

The bed of the stream should show clear, un-sedimented gravel. Instead the dominant and major composition of the biological growth covering metres of the bed was filamentous algae, with some fungal component.





Photos: Autumn 2018, Dr Nick Everall

We were concerned about two things:

The **overnight factory wash** discharge, and the **day time salad washing** discharge.

Next steps

These results lead us to complain in June 2018 to the EA under the Environmental Damage Regulations (EDR).

EDR lead to the EA monitoring the overnight wash discharge and daily salad wash water for chemicals including pesticides.

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March 2019

Bakkavor stopped using Chlorine products to clean the factory.

Now chemicals used every night to clean the factory's equipment will not be able to react to form chloramines which are highly toxic to water life even in extremely low concentrations.

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Sewage and pesticides from a salad washing factory owned by Bakkavör Group Plc may present a serious threat to aquatic invertebrate life in Alresford Pond.

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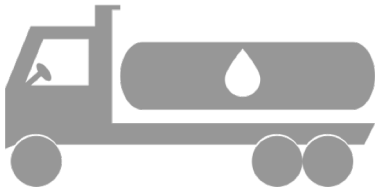
The investigation revealed a failing in the factory's own sewage works.

The sewage is now being tankered away and S&TC says discharges should not restart.



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The investigation also exposed a potential pesticide threat.

The EA has not been able to rule out damage from traces of pesticides present on the salad leaves, which are being subsequently washed into the Upper Itchen.

Trials are now on site to remove these pesticides.

SmartRivers

Protection into the future

The Riverfly Census was a real eye opener but sadly, monitoring like this is expensive and usually the first thing that is cut when resources are in decline.

We wanted to continue detailed investigations into water quality, so we packaged up the Riverfly Census into **SmartRivers**.

SmartRivers is volunteers kick-sweep sampling to professional guidelines twice a year, and identifying to **species-level**.

RP/ARMI monitoring and SmartRivers are **complimentary**. SmartRivers falls under the ‘Riverfly Plus’ umbrella.

SmartRivers is data with power. Quality control and support are built in so we can use what you find to **drive action**.

The SmartRivers Framework

BENCHMARKING

At the chosen sample sites (usually five) in spring and autumn for one year, samples are collected and identified **BY AN EXPERT**

This provides us with a confident baseline and helps us tailor training to the invertebrate species found in that river

TRAINING

Two separate training days completed in conjunction with the benchmarking: **SAMPLE** & **ID**

Benchmarking samples used to familiarise volunteers with their expected species

Depending on their preference, hubs can 'sample & identify' or 'sample & send'

DATA CRUNCHING

Volunteers submit their buckets/identified species lists twice a year

S&TC use the information to **CALCULATE STRESS SCORES** and enter the values into our national database

S&TC provide support including interpretation of the metrics and guidance on next steps

SmartRivers

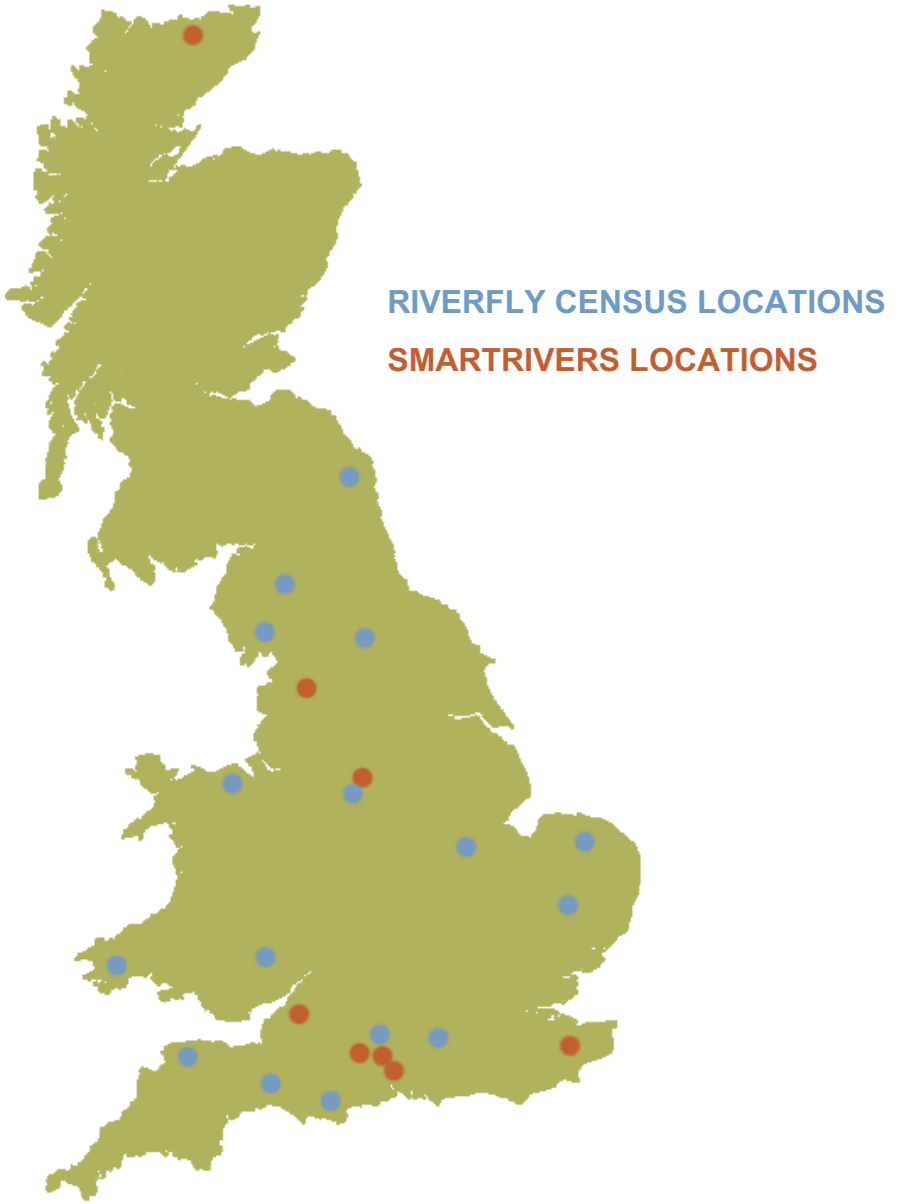
Protection into the future

Since the launch earlier this year, we have established **8 SmartRivers hubs**.

This includes our first venture into Scotland, the River Halladale.

Three of these hubs were existing Riverfly Census rivers.

We are in progress of expanding even further.



THANKYOU FOR LISTENING

ANY QUESTIONS?

www.salmon-trout.org